# D5.6 – HRS prototype service

**WP 5 – Demonstrator Integration, Testing and Homologation**

**Task 5.6 – HRS prototype service**



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## Contributions Table

| Partner | Contribution |
|---|---|
| CNH2 | Deliverable development. Responsible for the transport, assembly, commissioning and operation of the HRS prototype at each location. |
| CAF | Review of the deliverable |
| ADIF | Review of the deliverable and Quality Check |
| DLR | Review of the deliverable |

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# Executive Summary

The main objective of the FCH2RAIL project is to develop, build, test, demonstrate and homologate a scalable, modular and multi-purpose Fuel Cell Hybrid PowerPack (FCHPP) suitable for different rail applications (multiple unit, mainline and shunting locomotives) as well as for retrofitting existing electric and diesel trains.

Following the development, building and testing of the FCHPP it was installed and commissioned on an electric Civia train, thus becoming a Bi-mode hybrid train.

The testing phase of the Demonstrator train took place on Spanish and Portuguese tracks. During part of the tests on the railway system, CNH2 provided a hydrogen refuelling station (HRS) prototype to supply hydrogen to the Demonstrator train. This modular and portable HRS was installed in three different regions of Spain.

The HRS service experience has been documented in a video. The video is part of the public deliverable D5.6. This deliverable is an output of task 5.6, which focuses on the activities and data logging carried out with the HRS during the train testing phase.

The video can be consulted through the following link: https://youtu.be/RkGnYSADNO0


*Figure 1. HRS operation video on Youtube*

This video shows the installation, commissioning and operation of the HRS in the three selected locations and provides evidence of the fulfilment of an important part of the task. To fully complete the task, it is necessary to provide the deliverable D5.7 with the analysis and conclusions of the HRS data logs.



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# Glossary of Terms

| Acronyms | Description |
|---|---|
| CA | Consortium Agreement |
| FCHPP | Fuel Cell Hybrid PowerPack |
| FCH2Rail | Fuel Cell Hybrid PowerPack for Rail Applications |
| GA | Grant Agreement |
| HRS | Hydrogen Refuelling Station |
| TRL | Technological Readiness Level |



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# Contents

# 1. HRS service

The HRS prototype has refuelled the train during part of the on-track tests. The provided HRS is modular, so it can work on different configurations depending on the needs to be met, and portable, so it can be easily transported.

The HRS comprises four 20-foot containers:

- A dispenser, primarily responsible for transferring hydrogen to the storage tanks of the demonstrator train;
- Two storage containers housing Type I bottles at nominal pressures of 450, 500, and 900 bars;
- And a compressor, which compresses gaseous hydrogen supplied from a gas truck to the specified storage pressure.

The dispenser and both storage containers were supplied by Calvera and the compressor by Hiperbaric.

The HRS can operate with all four containers, with three of them (omitting one of the storage containers) or solely with the dispenser container.

The portability of the HRS has been particularly important as, in order to provide service to the train during part of the on-track tests, it has been necessary to install the HRS in three different Spanish regions (Aragon, Madrid and Galicia).

The HRS prototype developed within the framework of the project has refuelled the train from November 2023 to April 2024. During this period the HRS has refuelled the train 20 times, supplying it in total with about 2200 kg of hydrogen. The different geographical locations, together with testing in different seasons made it possible to gain refueling experiences under a wide range of climatic conditions.

In each location, the activities carried out with the HRS were the following:

- Transportation
- Unloading and positioning
- Assembly and commissioning
- Operation
- Dissasembly and preparation for return transport

In addition to the logistical and technical activities, administrative procedures were required with the each regional governments in order to register the HRS.

## 1.1 HRS in Aragon

The first location for installing the HRS was at the CAF facilities in Zaragoza. The HRS was received in September 2023. From that point in time onwards, assembly and commissioning were carried out.



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Finally, between November 2023 and January 2024, the train was refuelled eight times, allowing it to travel on the Zaragoza-Soria and Zaragoza-Teruel lines.

*Table 1. Refuelling dates in Aragon*

| Refuelling Dates | HRS location |
|---|---|
| 16/11/2023 | ZARAGOZA - CAF facilities |
| 18/11/2023 | |
| 28/11/2023 | |
| 11/12/2023 | |
| 15/12/2023 | |
| 19/12/2023 | |
| 08/01/2024 | |
| 10/01/2024 | |

*Figure 2. HRS arriving at CAF facilities*



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*Figure 3. HRS unloading at CAF facilities (1/2)*

*Figure 4. HRS unloading at CAF facilities (2/2)*



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*Figure 5. HRS commissioning at CAF facilities*

*Figure 6. Leak testing*



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*Figure 7. Installation of HRS at CAF facilities (1/2)*

*Figure 8. Installation of HRS at CAF facilities (2/2)*



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*Figure 9. Refuelling process with the HRS at CAF facilities*

## 1.2 HRS in Madrid

At the end of January 2024 the HRS was transported to its second location, El Goloso military base in Madrid. With the experience acquired previously the assembly and commissioning activities required less time. On the 12th of February the HRS carried out its first refuelling at this location and on the 28th of February the last refuelling took place.

*Table 2. Refuelling dates in Madrid*

| Refuelling Dates | HRS location |
|---|---|
| 12/02/2024 | MADRID - El Goloso |
| 14/02/2024 | |
| 15/02/2024 | |
| 16/02/2024 | |
| 24/02/2024 | |
| 28/02/2024 | |



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*Figure 10. HRS unloading at El Goloso*

*Figure 11. HRS commissioning at El Goloso (1/2)*



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*Figure 12. HRS commissioning at El Goloso (2/2)*


*Figure 13. Installation of HRS at El Goloso (1/2)*



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*Figure 14. Installation of HRS at El Goloso (2/2)*

## 1.3 HRS in Galicia

The last location of the HRS was at the Stellantis facilities, Porriño (Pontevedra). At this location the HRS arrived at the beginning of March 2024. In the period between the 1st and the 17th of April the HRS refuelled the train six times, allowing the train to travel on both Spanish and Portuguese railway infrastructure lines.

*Table 3. Refuelling dates in Galicia*

| Refuelling Dates | HRS location |
|---|---|
| 01/04/2024 | PONTEVEDRA - Stellantis facilities |
| 08/04/2024 | |
| 14/04/2024 | |
| 15/04/2024 | |
| 16/04/2024 | |
| 17/04/2024 | |



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*Figure 15. HRS arriving at Stellantis facilities*


*Figure 16. HRS unloading at Stellantis facilities*



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*Figure 17. HRS commissioning at Stellantis facilities*


*Figure 18. Refuelling process with the HRS at Stellantis facilities*

## 2. Conclusions

The transportable H2 refuelling solution developed by CNH2 for the project FCH2RAIL made it possible to refuel the train for the test and demonstration runs at three different locations under a wide range of climatic conditions.

In total, the train was filled with about 2200 kg of H2 in 20 refuelling operations.

Not only were technical solutions developed, but in particular the administrative procedures with the three regional governments were also successfully mastered.

The HRS developed in the project is thus the first transportable H2 refuelling solution for rail vehicles to be successfully used several times in Spain.

This deliverable, including the video, complies with the part of task 5.6 on compiling the HRS activities during the train testing phase.

The project is grateful for the key collaboration of the military base of El Goloso and the company STELLANTIS, which have ceded the use of their facilities in Madrid (El Goloso) and Porriño (Pontevedra), respectively, to install the HRS there, thus allowing the refuelling of the demonstrator train and, therefore, the correct execution of task 5.6.



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# 3. References

[1] European Comission, “Grant Agreement Number- 101006633 - FCH2Rail,” 2020.

[2] Consortium FCH2Rail Project, “Consortium Agreement FCH2Rail,” 2020.



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## A.1 List of Figures



## A.2 List of Tables





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